The invention in which an exclusive right is claimed is defined by the following:

1. An illumination system adapted to increase an amount of light incident upon an object that is moving relative to the illumination system, comprising:

(a) a light source producing a beam of light; and

(b) a first reflecting surface and a second reflecting surface disposed opposite each other and maintained in a facing relationship so as to define a reflection cavity, said reflection cavity having a field of view through which the object passes between the first reflecting surface and the second reflecting surface, said beam of light being incident upon the first reflecting surface at an acute angle relative to a normal to the first reflecting surface, said beam of light being reflected back and forth between the first and second reflecting surfaces so as to cross the field of view a plurality of times, said beam of light thus being incident on the object a plurality of times as the object traverses the field of view.

2. The illumination system of Claim 1, wherein the light source comprises a laser.

3. The illumination system of Claim 2, wherein the laser comprises one of a continuous wave laser and a pulsed laser.

4. The illumination system of Claim 1, wherein the object is entrained in a fluid that flows through the field of view.

5. The illumination system of Claim 1, further comprising a third reflecting surface that reflects the beam of light exiting the reflecting cavity back along its path and into the cavity, so that the beam of light reflected from the third reflecting surface is again reflected back and forth across the reflection cavity between the first reflecting surface and the second reflecting surface, traversing the reflection cavity a further plurality of times.

6. The illumination system of Claim 1, wherein the first and second reflecting surfaces comprise first and second reflective coatings disposed on a transparent substrate.

7. The illumination system of Claim 1, wherein the first reflecting surface and the second reflecting surface are separated by a distance, and the angle at which the beam of light is incident on the first reflecting surface and the distance are selected such that the beam of light is caused to overlap itself as it intersects a path along which the object traverses the field of view, when the beam is reflected between the first reflecting surface and the second reflecting surface.

8. The illumination system of Claim 1, wherein the first reflecting surface and the second reflecting surface are separated by a distance, and the angle at which the beam of light is incident on the first reflecting surface and the distance are selected such that the beam of light passes through the field of view without overlapping itself as it intersects a path along which the object traverses the field of view, when the beam is reflected between the first reflecting surface and the second reflecting surface.

9. The illumination system of Claim 1, further including an aperture that is disposed along a path of the beam of light so as to reduce a cross section of the beam of light transmitted through the aperture such that a variation in light intensity across the beam of light that is transmitted through the aperture is reduced.

10. The illumination system of Claim 1, wherein the first reflecting surface forms an acute angle with the second reflecting surface, said acute angle being selected so that the beam of light that is reflected back and forth between successively different points along the first reflecting surface and the second reflecting surface that are spaced apart in a first direction eventually begins to reflect back and forth between successively different points along the first reflecting surface and the second reflecting surface in a second direction that is opposite to the first.

11. The illumination system of Claim 1, wherein at least one of the first reflecting surface and the second reflecting surface is curved to focus the beam of light onto an axis along which the object moves through the reflection cavity, to reduce a spread of the beam of light where the beam of light illuminates the object.

12. The illumination system of Claim 11, wherein said at least one of the first and the second reflecting surfaces is curved about one of a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

13. The illumination system of Claim 11, wherein said at least one of the first and the second reflecting surfaces is curved about both a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

14. A light collection system, adapted to determine one or more characteristics of an object while there is relative movement between the object and the light collection system, comprising:

(a) a light source that produces a beam of light;

(b) a first reflecting surface and a second reflecting surface opposite the first reflecting surface, said first reflecting surface and said second reflecting surface being maintained in a facing relationship so as to define a reflection cavity, said reflection cavity including a field of view through which the object passes, said beam of light being incident on the first reflecting surface at an acute angle relative to a plane normal to the first reflecting surface, said beam of light being reflected back and forth between the first reflecting surface and the second reflecting surface so as to cross the field of view a plurality of times at different points along the field of view, thereby illuminating the object a plurality of times as the object traverses the field of view;

(c) a collection lens disposed so that light traveling from the object passes through the collection lens and travels along a collection path; and

(d) a detector disposed to receive the light collected by the collection lens, producing an output signal that is indicative of at least one characteristic of the object.

15. The light collection system of Claim 14, wherein the object is entrained in a fluid that passes through the field of view.

16. The light collection system of Claim 14, further comprising a third reflecting surface that causes the beam of light exiting the reflecting cavity to be reflected back along a path it followed from the reflecting cavity and to be reflected back and forth across the reflection cavity between the first reflecting surface and the second reflecting surface a further plurality of times.

17. The light collection system of Claim 14, wherein the first reflecting surface and the second reflecting surface respectively comprise first and second reflective coatings disposed on a transparent substrate.

18. The light collection system of Claim 14, wherein the first reflecting surface and the second reflecting surface are separated by a distance, and the angle at which the beam of light is incident upon the first reflecting surface and the distance are selected such that the beam of light is caused to overlap itself as it intersects a path along which the object traverses the field of view, when reflected between the first reflecting surface and the second reflecting surface.

19. The light collection system of Claim 14, wherein the first reflecting surface and the second reflecting surface are separated by a distance, and the angle at which the beam of light is incident on the first reflecting surface and the distance are selected such that the beam of light passes through the field of view without overlapping itself as it intersects a path along which the object traverses the field of view, when reflected between the first reflecting surface and the second reflecting surface.

20. The light collection system of Claim 14, wherein the first reflecting surface forms an acute angle with the second reflecting surface, said acute angle being selected so that the beam of light that is reflected back and forth between successively different points along the first reflecting surface and the second reflecting surface that are spaced apart in a first direction eventually begins to reflect back and forth between successively different points along the first reflecting surface and the second reflecting surface in a second direction that is opposite to the first.

21. The light collection system of Claim 14, wherein at least one of the first reflecting surface and the second reflecting surface is curved to focus the beam of light onto an axis along which the object moves through the reflection cavity, to reduce a spread of the beam of light where the beam of light illuminates the object.

22. The light collection system of Claim 21, wherein said at least one of the first and the second reflecting surfaces is curved about one of a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

23. The light collection system of Claim 21, wherein said at least one of the first and the second reflecting surfaces is curved about both a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

24. A flow cytometer system, adapted to determine one or more characteristics of an object suspended in a flow stream from an image of the object, comprising:

(a) a light source that produces a beam of light;

(b) a first reflecting surface and a second reflecting surface maintained in an opposite, facing relationship so as to define a reflection cavity including a field of view traversed by an object, said beam of light being incident upon the first reflecting surface at an acute angle relative to a normal to the first reflecting surface and being reflected back and forth between the first reflecting surface and the second reflecting surface so as to cross the field of view a plurality of times, thereby illuminating the object as it passes through the field of view;

(c) a first set of optics disposed so that light traveling from the object passes through the first set of optics so as to produce a first image of the object; and

(d) a first light detector disposed so as to receive the first image of the object, said first light detector detecting at least one characteristic of the object.

25. The flow cytometer system of Claim 24, wherein the first light detector comprises a time-delay integration (TDI) detector that produces an output signal by integrating light from at least a portion of the object over time.

26. The flow cytometer system of Claim 24, wherein the first light detector comprises a photomultiplier tube.

27. The flow cytometer system of Claim 24, wherein the first reflecting surface and the second reflecting surface are supported by a support member.

28. The flow cytometer system of Claim 24, further comprising:

(a) a second set of optics disposed so that light traveling from the object passes through the second set of optics so as to produce a second image of the object; and

(b) a second TDI detector disposed so as to receive the second image, said second TDI detector producing a second output signal that is indicative of at least one characteristic of the object, said second TDI detector producing the second output signal by integrating light from at least a portion of the object over time, wherein the first and second output signals are combined to produce a stereo image of the object.

29. The flow cytometer system of Claim 24, wherein the first set of optics comprises a microscope objective.

30. The illumination system of Claim 24, wherein the first reflecting surface forms an acute angle with the second reflecting surface, said acute angle being selected so that the beam of light that is reflected back and forth between successively different points along the first reflecting surface and the second reflecting surface that are spaced apart in a first direction eventually begins to reflect back and forth between successively different points along the first reflecting surface and the second reflecting surface in a second direction that is opposite to the first.

31. The illumination system of Claim 24, wherein at least one of the first reflecting surface and the second reflecting surface is curved to focus the beam of light onto an axis along which the object moves through the reflection cavity, to reduce a spread of the beam of light where the beam of light illuminates the object.

32. The illumination system of Claim 31, wherein said at least one of the first and the second reflecting surfaces is curved about one of a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

33. The illumination system of Claim 31, wherein said at least one of the first and the second reflecting surfaces is curved about both a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

34. An illumination system adapted to increase an amount of light incident upon an object that is moving relative to the illumination system, comprising:

(a) a light source producing a beam of light; and

(b) a first reflecting surface and a second reflecting surface disposed opposite each other and maintained in a facing relationship so as to define a reflection cavity, said reflection cavity having a field of view through which the object passes between the first reflecting surface and the second reflecting surface, said first reflecting surface being disposed at an acute angle with respect to said second reflecting surface, said beam of light being incident upon the first reflecting surface at an acute angle relative to a normal to the first reflecting surface, said beam of light being reflected back and forth between the first and second surfaces so as to cross the field of view a plurality of times, said beam of light being incident on the object as the object traverses the field of view.

35. An illumination system adapted to increase an amount of light incident upon an object that is moving relative to the illumination system, comprising:

(a) a light source producing a beam of light; and

(b) a first reflecting surface and a second reflecting surface disposed opposite each other and maintained in a facing relationship so as to define a reflection cavity having a field of view through which the object passes between the first reflecting surface and the second reflecting surface, at least one of said first and said second reflecting surfaces being curved so as to have an optical power greater than one, said beam of light being incident upon the first reflecting surface at an acute angle relative to a normal to the first reflecting surface, said beam of light being reflected back and forth between the first and second surfaces so as to cross the field of view a plurality of times, said beam of light being incident on the object as the object traverses the field of view and focussed upon the object by said at least one of said first and second reflecting surfaces that is curved.

36. The illumination system of Claim 35, wherein said at least one of the first and the second reflecting surfaces is curved about one of a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.

37. The illumination system of Claim 35, wherein said at least one of the first and the second reflecting surfaces is curved about both a first axis that is generally aligned with a direction of travel of the object, and a second axis that is generally orthogonal to the direction of travel of the object through the reflection cavity.